A Study on the Neogene Plants of the Inner Side of Central Honshū (Hokuriku Region), Japan. I: On the Genus *Comptoniphyllum* Nathorst.

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I. Introduction

The genus *Comptoniphyllum* has been usualy considered to imply the plants with its characteristic deltoid-segmented leaves of the Miocene Flora common in Japan, which very closely resembles the Recent species *Comptonia peregrina* Linné** from the Appalachian Mountains region. Its occurrence has been believed to characterize the "Daijima Flora" of Japan.

This genus has been studied by several palaeophytologists, specialized in Neogene plants. Among them, S. Endô and Morita (1933: 43-46) regarded *C. japonicum* as synonymous with *C. naumanni*. These two species were described by A. G. Nathorst in 1888 (*C. naumanni*; 202-203, XVIII, fig. 2 and *C. japonicum*; 207-208, XX, figs. 2 & 3, and XXI, fig. 3). It is the fossils from the following two localities in the Hokuriku region that these authors reported, namely, the northern part of Noto Peninsula and the upper reaches of the Tedori-Gawa (river). These localities had been known as the only places that yieled *Comptoniphyllum*, until the writer discoverd in 1950 (1951; 139) a new locality at Kawaminami in Ishikawa Prefecture.

Moreover, it proved to be valuable for the determination of the stratigraphical position of the diatomaceous bed widely exposed in the middle part of Noto Peninsula (W. Ichikawa, and two members: 1955). Consequently, this diatomaceous mud bed is found to have corresponding beds in the other areas of Noto Peninsula, and the Miocene strata in the Hokuriku region in general.

Before proceeding, the writer wished to express his sincere thanks to the members of the Geological Institute, and Geobotanical Institute, Kanazawa University; he is deeply indebted among others to N. Satomi, Lecturer, who kindly two managed to give him to opportunity of examining Recent

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** Some taxonomists used *Myrica peregrina* (L.), *Comptonia asplenifolia* Gaertin or *Myrica asplenifolia* Linné.

species of *Comptonia peregrina* and *Myrica rubra*. The writer is especially grateful to Dr. R. T. M. PESCOTT, Director of the Melbourne Botanic Gardens, South Yerra, Australia, who spared him specimens of *Dryandra formosa* and *Banksia grandis* together with the detailed data of these species. Last but not the least are his thanks due to Dr. I. HAYASAKA for his kind criticism, and reading the manuscripts of this paper.

II. The Localities hitherto known of *Comptoniphyllum* in the Hokuriku Region.

S. ENDÔ and H. MORITA made known two localities of *Comptoniphyllum naumanni* in the Hokuriku region, namely;

1) Noroshin, Seikai-Mura, Suzu-Gôri, Noto Province.
   Collector: Mr. O. AOJI.
   Repository: Institute of Geology and Palaeontology, Tohoku Imperial University, Sendai.
2) Siramine-Mura, Nomi-Gôri, Kaga Province.
   Collector: Mr. KOBATAKE; reported by Dr. H. YABE in 1901.
   Repository: Institute of Geology, Tokyo Imperial University.

The first locality was incorporated with Noroshi-Machi, Suzu City, Ishikawa Prefecture in 1954. According to AOJI's personal detailed information, many specimens of this species were collected in 1951, in association with a lot of broad-leaves. Subsequently, in 1956, Drs. S. ISHIDA and K. MASUDA proposed to call these leaves with this species, the Noroshi Flora.

About the second locality, the information about the details has been scarce, except that Dr. H. YABE reported to a leaflet discovered by Mr. KOBATAKE in the upper reaches of the Tedori-Gawa in 1901 (328). He suggested "it should be *Comptoniphyllum japonicum* NATHORST—," but he did not mention its locality. According to the present knowledge, Shiramine-Mura is a region of the Jurasso-Cretaceous plants of the so-called "Tetori Flora."

Therefore, the writer is inclined to consider that the Neogene plants seem to have abundantly occurred from Kawarayama, Torigoé-Mura, Ishikawa-Gun, Ishikawa Prefecture, the locality in the upper reaches of the Tedori-Gawa: this locality has been long known for the occurrence of the "Konoha-ishi (leaf stone)." These Neogene plants were collected in 1951 by K. KAWASAKI, a primary school teacher of Torigoé-Mura. He presented to the writer a foliage of *Metasequoia japonica* and some broad leaves (*Salix* sp., *Carpinus* sp.? and *Qurcus* sp. etc.). The same horizon is recognized by means of some plant fossils of the similar stage at Gohyaku-togé, Shinmaru-Mura, Nomi-Gun, Ishikawa Prefecture and at Ôtsuchi, Higashitanioku-Mura,

Enuma-Gun, Ishikawa Prefecture. These two localities have been known since older times (A. G. NATHORST: 1888; 20, 215 and 236): and the former locality has yielded *Trapa borealis* HEER var. *major* NATHORST (1888; 20). To speak of the genus *Trapa*, another species, *T. yokoyamae* was recorded by A. G. NATHORST (Op. cit., 215, XXIII, figs. 6-8) from the nieghbourhood of the Ogoya Mine, Nishio-Machi, Komatsu City, Ishikawa Prefecture; which S. ENDÔ (1932; 46) regarded to be the Palaeogene species. But the geological horizon of these localities is suggested to be corresponding to the so-called "Green-tuff Group" of the Neogene strata Inner Side of Honshû, Japan.

In 1953, S. TANINAMI, a graduate of the Kanazawa University, collected leaves of *Acer* sp., *Liriodendron* sp., *Magnolia* sp., *Platanus* sp., *Salix* sp., *Zerlkova* sp., etc. at Ôtsuchi (A. G. NATHORST referred to two species, cf. *Carpinus grandis* UNGER and *Querciphyllum lonchitis* NATHORST in 1888;236).

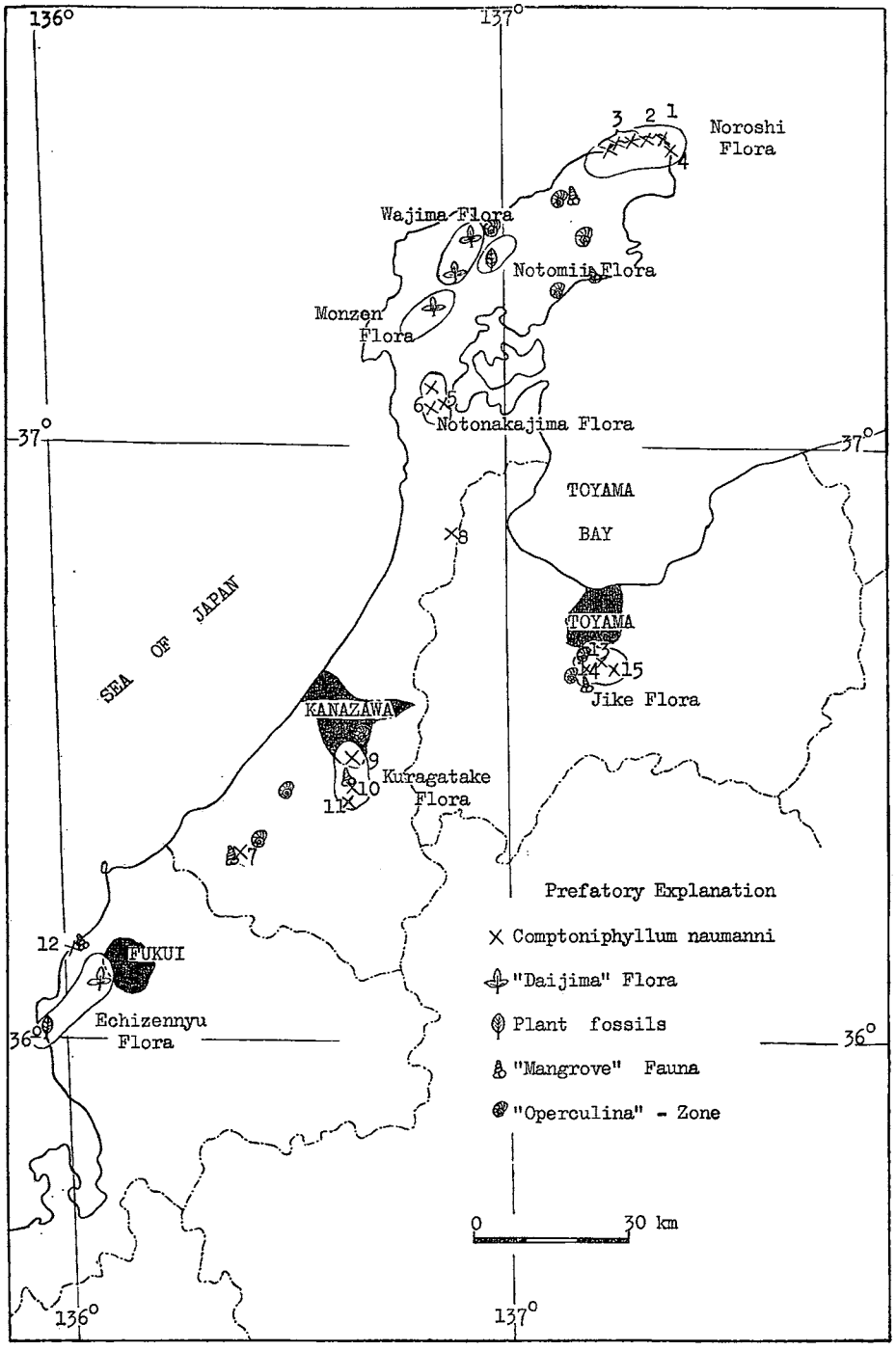
However, from the above mentioned localities *Comptoniphyllum* has not been found notwithstanding that they belong to the field of the so-called "Green-tuff Group": it should be expected to discover elements of the flora in near future.

In the meantime, Mr. K. KAWASAKI informed the writer that he discovered the very point of occurrence of a leaf of *Comptoniphyllum* at Kamino, Torigoé-Mura, Ishikawa-Gun, Ishikawa Prefecture, in 1957. Although this locality has been known for a long time for the occurrence of the "*Konohaishi*," the account has not been published. The writer consideres that this locality should be the place where Dr. H. YABE's reported material from an "unknown locality" in the upper reaches of the Tedori-Gawa (H. MATSUO: 1958; 156).

Beside the two localities mentioned by S. ENDÔ and H. MORITA, a few more have been added to in the Hokuriku region. The members of Kyoto University, who attended the geological survey in the Neogene area in Ishikawa and Toyama Prefecture, collected leaves of *Comptoniphyllum naumanni* and other plant fossils in the upper reaches of the Sai-Kawa, Kanazawa City (M. ICHIHARA and 4 members: 1950; 23), and in the vicinity of Yatsuo-Machi, Toyama Prefecture. In the former locality, they found this species in the lower horizon of the "*Operculina* zone" with *O. complanata* var. *japonica* HANZAWA, *Astriclypeus* sp. and some molluscan species at Nozoki, outskirts of Kanazawa City. In the latter locality, the exact point of occurrence has not easily been to be found:*** according to the opinion of Prof. N. IKEBE (1949; 21), who made a geological research in this area, the species

*** On the localities, the writer was personally informed indetail by Dr. K. TSUDA of Niigata University ; these points are a) River side of the Nozumi-Gawa, and b) River side of the Muromaki-Gawa ; both points being in the southern outskirts of Yatsuo-Machi.

Fig. 1 : Distributional Map of *Comptoniphyllum naumanni* with "Mangrove" fauna and "*Operculina* "-zone, ect. in the Inner Side of Central Honshû, Japan.



Comptoniphyllum naumanni was found associated with leaves of *Liquidambar formosana* HANCE, which seems to suggest the horizon of the Vicaryan Fauna (the so-called "Mangrove fauna").

In 1947, Dr. K. MASATANI of the Geological Survey of Japan, presented to Prof. Y. KASENO of Kanazawa University many fossils yielded in the vicinity of Sasazu, east of Yatsuo-Machi, among which a few leaves of *Comptoniphyllum naumanni* were found. The exact point of occurrence is a road-cut about 250 m north of Sasazu station of the Takayama Line.****

III. The New Localities in the Hokuriku Region

(Locality numbers correspond to those of the distributional chart).

The followings are the new localities of the genus *Comptoniphyllum* beside that at Noroshishin.

A) Noroshi Flora

1: (A-1); Noroshishin, Noroshi-Machi, Suzu City, Ishikawa Prefecture (Suzu-misaki).*****

Lat. 37°31′14″ N. & Long. 137°19′50″ E.

Collectors: K. KOJIMA and H. MATSUO (Oct. 1951): Members of the Kanazawa University (1954); K. TSUDA and H. MATSUO (Aug. 1959).

2: (A-2); Orito, Noroshi-machi, Suzu City, Ishikawa Prefecture (Suzu-misaki).

Collectors: T. KATÔ (July, 1952), a teacher of primary school of Fukui City; K. Masuda (1952), a member of the Tohoku University, Sendai.

3: (A-3); Wanizaki, Kourade & Takaya, Noroshi-Machi, Suzu City, Ishikawa Prefecture (Matsunagi).

Collectors: At Wanizaki by T. ARAKIDA (July, 1952), a graduate of the Kanazawa University; at Kourade and Takaya by S. ISHIDA (1952), a member of the Kyoto University.

4: (A-4); Ohsaki, Ueno-Machi, Suzu City, Ishikawa Prefecture (Suzu-misaki).

Collectors: K. MASUDA and S. ISHIDA (1952); K. TSUDA and H. MATSUO (Aug. 1959).

B) Notonakajima Flora

5: (B-1); Kanmachi, Nakajima-Machi. Kashima-Gun. Ishikawa Prefecture (Nanao)

Lat. 37°7′5″ N. & Long. 136°50′24″ E.

Collectors: W. ICHIKAWA and K. KOJIMA (1951), members of the Kanazawa University; T. HOTTA, S. KIDA, K. MOTÔ, H. MATSUSHIMA, K. KOJIMA and H. MATSUO (Oct. and Nov. 1951); K. TSUDA and

**** The writer visited this locality to make collection of this species in 1952 and 1959, but unfortunately in vain.

***** Rounded brackets imply the name of the Topographical sheet in scale of 1/50,000.

H. Matsuo (Aug. 1959).

6: (B-2); Tsuchikawa, Nakajima-Machi, Kashima-Gun, Ishikawa Prefecture (Nanao).

Lat. 37°6′49″ N. & Long. 136°49′15″ E.

Collectors: K. Kojima and H. Matsuo (Oct. 1953); K. Tsuda and H. Matsuo (Aug. 1959).

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7: Kawaminami, Yamanaka-Machi, Enuma-Gun, Ishikawa Prefecture (Daishôji).

Lat. 36°16′42″ N. & Long. 136°21′4″ E.

Collectors: H. Matsuo (July, 1950); Y. Kaseno and T. Hashimoto (1952), members of the Kanazawa University.

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8: Tarumidaki, NE 2km of Nota village, Shio-Machi, Hakui-Gun, Ishikawa Prefecture (Isurugi).

Collectors: J. Muramoto (Aug. 1955) a teacher of the middle school of Takaoka City, Toyama Prefecture.

C) Kuragatake Flora

9: (C-1); Kuragatake-Machi, Kanazawa City, Ishikawa Prefecture (Tsurugi).

Lat. 36°28′17″ N. & Long. 136°38′45″ E.

Collectors: K. Kojima and H. Matsuo (1951); K. Ômura and H. Matsuo (1964).

10: (C-2); Kamino, Torigoé-Mura, Ishikawa-Gun, Ishikawa Prefecture (Tsurugi).

Collectors: K. Kawasaki (1956), a teacher of the primary school of Torigoé-Mura.

11: (C-3); Mikoshozu, Torigoé-Mura, Ishikawa-Gun, Ishikawa prefecture (Tsurugi).

Collectors: K. Kita and H. Matsuo (Oct. 1959).

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12: Aikawa, Kunimi-Mura, Nyu-Gun, Fukui Prefecture (Fukui)

Collector: A school boy of the Kunimi Middle School (1952).

Repository: The Fukui Municipal Museum, Fukui City.

D) Jike Flora

13: (D-1); Yakiyama Station of Toyama Chitetsu Line, Ôsawano-Machi, Kaminiikawa-Gun, Toyama Prefecture (Yatsuo).

Collector: Y.Kirii (1954), a techer of the Sasazu Middle School.

14: (D-2); Nagahashiri, Ôsawano-Machi, Kaminiikawa-Gun, Toyama Prefecture (Yatsuo).

Collector: K. Tsuda (1955), a member of the Niigata University,

15: (D-3) Jike, Funakura-Mura, Kaminiikawa-Gun, Toyama Prefecture (Yatsuo).

Collectors: Y. Kirii (1959); K. Tsuda and H. Matsuo (1959).

Among the above localities, those of Noroshishin, Orito, Wanizaki, Kourade, Takaya and Ohsaki belong to the Noroshi Flora. Dr. K. MASUDA informed the writer in a letter some detalis of the fossil localities. From Orito toward Kinoura, there are localities a) 600 m NW; b) 1,200 m WNW; and c) 1,400 m SW from Orito village; and 200 m S from Orito toward Higashiyamanaka village.

At Kanmachi and Tsuchikawa in the middle part of Noto Peninsula, there is the same horizon of the diatomaceous layer bearing *Plenasium lignitum*, belonging to the Notonakajima Flora (in 1958, the writer established the Kanmachi flora for its flora). This flora contains many needle leaves like *Pinus miocenica*, *Pseudotsuga* cfr. *yezoana* and *Cunninghamia protokonishii*, and cupressus leaves of *Fukienea notoensis*, as well as many deciduous leavas *Quercus* spp., *Diospyros miokaki*, etc.

At Kawaminami, the writer discovered for the first time in 1950 the occurrence of Vicaryan shells ("Mangrove Fauna"), and *Comptoniphyllum naumanni* at 2 m below the nodulous layer with the molluscan shells (Vicarya, Anadara, Solen, etc.) and crabs.

At Tarumidaki, Mr. J. MURAMOTO discovored an incomplete leaf of *C. naumanni* during his field-works for the graduation thesis of the Kanazawa University, in 1955. Although the specimen at hand is only one, imperfect impression, it can be determined to be *Comptoniphyllum naumanni*. It occurrs below the "Operculina" horizon.

A specimen of Kamino is the only material of *C. naumanni* at hand, but many more samples might be found there. In 1959, the writer and K. KITA collected a few specimens together in association with *Pinus* sp. *Smilax trinervis*, *Salix* sp. *Carya* spp., *Carpinus* spp., *Ostrya* cfr. *oregoniana*, *Fagus* sp., *Cyclobalanopsis* spp., *Quercus* spp., *Ulmus miopumilla*, *Zelkova ungeri*, *Celtis miobungeana*, *Magnolia* spp., *Cinnamomun* spp., *Lindera* sp.?, *Zizyphus miojujuba*, *Liquidambar formosana*, *Rhus* spp., *Ilex* sp., *Acer* sp., *Tilia* sp., *Hemitrapa borealis*, and *Nelumbium* sp., etc. at Mikoshozu. These localities yield similar and equivalent plants, so that the writer proposes the collective name the Torigoé flora (it is contained in the Kuragatake Flora). The horizon of this flora occurs beneath the "Mangrove Fauna" (which was collected by Mr. T. IKA, a principal of the middle school of the Torigoé-Mura in 1957, at Zyoyama, Torigoé-Mura.

The Aikawa material consists of only one speciman preserved in the Fukui Municipal Museum which was discovered it while endeavouring to collect materials for exhibition: this sample was obtained in 1952, by a Middle school boy of Kunimi-Mura, together with some molluscan shells of the "Mangrove Fauna" which occupies a horizon below the horizon yielding *Osmunda tsunenomorensis* and *Liquidambar formosana* in the Tôbu

Formation.

Concerning the last three localities, the writer personally informed by Mr. Y. KIRII and Dr. K. TSUDA At Yakiyama, Y. KIRII collected many nuts of *Carya* cfr. *miocathayensis* with a few fragments of the *Comptoniphyllum*. This horizon occupies the uppermost part of the Kurosedani Formation, on the one hand, it overlies a horizon of the "Mangrove Fauna" on the other. And Y. KIRII collected many specimens of this species at Jike; the horizon of Jike being in the lower part of the Kurosedani Formation. Thus the Jike fossil horizon underlies the horizon of the "Mangrove Fauna."

IV. On the Name of *Comptoniphyllum*

When A. G. NATHORST established the genus *Comptoniphyllum* from Japanese Neogene plants in 1888, he described two species *C. naumanni* from Shimohinokinai-mura, Senboku-gôri, Province Ugo (Shimohinokinai, Nishiki-Mura, Senboku-Gun, Akita Prefecture) and *C. japonicum* from Kamikanazawa-mura, Kuji-gôri, Province Hitachi (Kamikanazawa, Daigo-Machi, Kuji-Gun, Ibaraki Prefecture); his note is as follows (202-203);

"-- Es erinnert sehr an *Myrica* (*Comptonia*) *acutiloba* BRONGNIART, und ich betrachtete es zuerst auch als enine Varietät derselben. Es ist aber tiefer getheilt, die Lappen sind bis zum Primärnerv von einander getrennt, ihr vorderer und äusserer Rand ist gerader und die vordere Ecke spitzer als bei *Myrica acutiloba*. Die Lappen sind ferner breiter als lang ; man sieht mit der Lupe 4 grössere und dazwischen einige kleine Nerven in jedem ; das Blatt scheint ziemlich fest und lederartig gewesen zu sein. Dieses Stück stimmt sehr nahe mit den Blättern der jetzt lebenden *Myrica* (*Comptonia*) *asplenifolia* überein, und ich glaube, dass zwischen beiden ein genetischer Zusammenhang besteht. Auch der Bau der Blattspitze scheint für eine solche Verwandtschaft zu sprechen. Ich würde es demgemäss für gerechtfertigt gehalten haben, diese Blätter bei *Myrica* unterzubringen, wenn nicht andererseits in den Tertiärablagerungen sehr ähnliche Blätter vorgekommen wären, welche als Proteacean aufgefasst worden sind. Es dürfte unter solchen Umständen richtiger sein, das Blatt bis auf weiteres zur provisorischen Gattung *Comptoniphyllum* zu bringen, was ja eine Zusammengehörigkeit mit (*Comptonia*) *Myrica* durchaus nicht ausschliesst.

Ausser dem abgebildeten Blatte liegt kleines Fragment vor, bei welchem wenigstens einer der Lappen mehr gerundet zu sein scheint, etwa wie bei *Myrica acutiloba*. Da aber die anderen Lappen unvollständig sind, lässt sich nicht entscheiden, ob diese Form nur eine zufällige ist."

The witer supports NATHORST's opinion, while Dr. T. TANAI (1955 ; 5) used the *Myrica* instead of *Comptoniphyllum* for the genus, by reason that its original name *Comptonia* was excepted from the modern taxonomy. In fact, BAILEY (1950: I; 836) remarked "—The genus is allied to *Myrica*, and by some not regarded as sufficiently different in botanical characters to justify

separate generic rank:—."

However, there are some botanists who prefer the name *Comptonia*. L. BENSON, for instance, in his description (1957; 316) of Myricaceae, noted as follows, namely, "The family is composed of only two genera, *Myrica* and *Comptonia*. These occur in cool areas in the North Temperate Zone and in South Africa.—"

On the other hand, Dr. K. SUZUKI (1961; 30) who studied this genus, concluded that *Comptonia* should be combined with a subgenus of *Myrica*.

But Dr. K. HUZIOKA (1961; 62) considered:"—it is palaeobotanically convenient to retain the name of *Comptonia* for those fossil leaves similar to the modern *Comptonia asplenifolia* L. As far as leaves are concerned, *Comptonia* is distinguishable from *Myrica* in the following points: Leaves of *Comptonia* are pinnatifid, while those of *Myrica* are entire, dentate, serrate, or at most incised. The form-genus *Comptoniphyllum* which was established by NATHORST (1888) on the leaves from the Utto formation at the Tsuchikumazawa locality in Akita Prefecture is not generically distinguishable from *Comptonia* as far as leaves are concerned." Thus, he used *Comptonia* for the deltoid and pinnatifid Tertiary Myricaceous leaves.

Nevertheless, the species *Comptoniphyllum naumanni* resembles the living species *Dryandra formosa* and *Banksia grandis* in the western part of Australia, and *Lyonothamnus aspleniifolius* in California: on the former species, S. ENDÔ and H. MORITA (1933; 41) discussed as follows:

> "Certain species of *Banksia* and *Dryandra* now living in Australia and the adjacent islands possess lobed leaves more or less similar to those of *Comptonia*. In *Banksia speciosa* R. BROWN and *B. grandis* WILLD, for instance, each lobe of their leaves shows a number of nerves at right angles to the rachis and the middle one, which is the strongest of all, runs straight to the tip of the lobe, while the other, lower and upper ones, are camptodrome, with their apical part converging gradually to that of the middle nerve. The lobed leaves of the living *Dryandra formosa* R. BROWN remined us more strongly of certain fossil leaves referred to *Comptonia*, and several Tertiary species of the latter were sometimes recorded under the generic name, *Dryandra*. The lobed leaves of *Comptonia* and *Dryandra* are somewhat different in general aspect, those of the latter being constantly much elongated, and there is little doubt about the closer alliance of the most of the *Comptonia*-like fossil leaves to *Comptonia* rather than to *Dryandra*, although any more decisive distinction does not seem to be practicable between the leaves of the two genera, when found in fossil state."

On comparing this fossil species with *Comptonia peregrina* of the eastern mountaineous land of the United States, and *Dryandra formosa* and *Banksia grandis* of the south-western part of Australia, the writer discovered that the former species shows the albescens-pilosula in the reverse side, while the two Australian species have some tenuifoliated leaf and show

pachyphylloidal and coriaceous leaves.

However, these species resemble one another very closely, except that the American species grows on hill-sides.

The American species reposited in the Herbarium of the Institute of Biology, Kanazawa University, was collected in the mountaineous land in North Carolina, about 5,000 feet (ca. 1,500m) above sea-level. Concerning the habitat, BRITTON and BROWN (1896; 489) remark that it grows as follows: "—in dry soil, especially on hill-sides, Nova Scotia to Manitoba, South to North Carolina, Indiana and Michigan, ascends to 2,000 feet (ca. 600m) in Verginia. —"

In Australia the other species is reported to grow as quoted below: "— together with *Banksia speciosa* they grow in very similar localities in South Western Australia. Some localities are—Darling Ranges, Warren, Stirling Ranges,—Sandy Plains near the Swan River, Heath Lands—King George's Sound. The soil is generally a sandy loam covering a well drained subsoil. The average normal rainfall varies from 10-25 inches (ca. 250-625mm) and occurs mostly in the Winter and Spring months." (after Dr. T. M. PESCOTT's letter in 1954).

Of *Lyonothamnus asplenii folius*, the writer has scrutinized BAILEY's figure (1950: II, 1935, fig. 2239), as well as of the other fossil species *L. moyavensis* AXELROD (1944: R. W. CHANEY Editor: pl. XXX, fig. 4). He considers that these resemble *Comptoniphyllum naumanni* in the roundly cut-off shape of the leaves. As a matter of fact, C. A. ARNOLD (1947; 362) remarked on the Myricaceae, as follows:—" The Myricaceae is represented by a few genera including *Myrica* and *Comptonia*. The latter genus is best represented in the Miocene although it is reported from formations as old as the Raritan. *Comptonia* is sometimes confused with the Rosaceous genus *Lyonothamnus*."

According to Dr. T. NAKAI's report (1935; 49) the Recent flora of Middle China (including five provinces of Kiangsu, Anhwei, Hupei, Chekiang and Szechwan) resembles more that of the eastern part of the United States of America than of the western part, as was recognized by Dr. A. GRAY long time ago.

The Miocene flora of Japan contains many of the elements of the Recent flora of Middle china, comprizing *Dryopteris, Osmunda, Abies, Cryptomeria, Cunninghamia, Libocedrus, Metasequoia, Smilax, Acer, Alnus, Aucuba, Betula, Carpinus, Carya, Celtis, Cercis, Cinnamomum, Cornus, Cyclobaranopsis, Diospyros, Dipteronia, Dodonea, Engelhardtia, Ficus, Fraxinus, Hydrangea, Ilex, Liquidambar, Liriodendron, Nyssa, Osmanthus, Ostrya, Quercus, Reevesia, Rhus, Salix, Sterculia, Styrax, Tilia, Ulmus, Viburnum, Vitis*, and *Zelkova* etc. among others.

Keeping in mind all what has been remarked above, the writer likes to

express his opinion about the relation between *Comptonia* and *Comptoniphyllum*. Provided that the Miocene floras of eastern United States and of our country fully coincide, the generic name *Comptonia* may well be used for the Japanese fossil plant called *Comptoniphyllum*.

However, the writer is strongly inclined to consider that *Comptoniphyllum* might have flourished as one of the ancient members of Rosaceae in the Northern Hemisphere. Besides, there is reason to disagree with the measure to use either *Myrica* or *Comptonia* in place of *Comptoniphyllum*: the characteristic deltoid leaves of the latter more closely resemble *Lyonothamnus* than *Comptonia*, morphologically, *Banksia* and *Dryandra* are also closely allied to *Comptoniphyllum*.

As to the habitat of *Comptoniphyllum*, it is suggested to have grown in regions with a temperate climate, and proximate to river-sides or plains, which *Comptonia peregrina* seems to have grown in semi-arid climate, and on hill-sides. Thus, the writer considers it not unreasonable to call the Japanese fossil under discussion *Comptoniphyllum* as distinct from *Comptonia*.

In order to scrutinize what appear to be contrasting features observed in living forms of *Myrica*, *Banksia*, *Comptonia peregrina* and *Lyonothamnus asplenifolius*; the writer has tried to summarize them in a table which follows (Table-1).

Tadle-1 : Characteristic features of *Myrica*, *Banksia*, *Comptonia* and *Lyonothamnus* as observed in the living species.

Characters / Species	Tree or Shrub	Leaves	Habitat
Myrica species	Woody plant	Evergreen. Short-petioled without stipples, entire or serrate ; resinous-punctata.	Hilly slope. About 50 spp. in the temperate and warmer region of both hemispheres.
Banksia species	Shrub or tree. More than 10 feet in height.	Evergreen. Deeply incised. 3-6 in. long.	46 spp. in Australia, Tasmania. And one species in New Guinea.
Comptonia peregrina	Shrub. 1-3 feet in height.	Oblong to oblanceolate (Fern-like) ; 3-6 in. long ; pinnatifidus.	Dry and sterial soil. East and North America. One species.
Lyonothamnus asplenifolius	Shrub or small tree, 7.5 ft. in height	Evegreen. Pinnately, divided 3-8, insidely lobulate segments, 4-8 in. long and $\frac{1}{2}\sim\frac{3}{4}$ in. wide.	Island. Santa Catalina Is. California.

Table-1 seems to show the writer that there are in reality, hardly any characteristic feature that distinguish them one from another.

Lastly, the writer has become aware of the existence of a few rounded scars of injury on the leaf (pl. IV, figs. 7, 11 and 12; V, fig. 7). These are considered by the writer to have been due to the life activities, as is often seem in the leaves of Fagaceae and Rosaceae.

If these scars were not found on the coriaceous leaves of Myricaceae and Proteaceae, *Comptoniphyllum* can not be classed with either of those families, but it should rather placed in *Lyonothamnus* of Rosaceae.

Thus, again, it is quite sure that the name *Comptoniphllum* should be used for the Miocene fern-like pinnatifidus leaves from the Japanese Islands, notwithstanding that there are some palaeobotanists who adhere to the used of *Comptonia*, instead.

V. On the Leaf-shape of *Comptoniphyllum*.

According to NATHORST (1888), there are two forms in the leaf-shape of *Comptoniphyllum*, recognized: one is triangularly segmented and the other roundedly cut-off. The former was called *Comptoniphyllum naumanni* and the latter, *C. japonicum*. S. ENDÔ and H. MORITA (1933; 43-46) remarked that the latter species is synonymous the former, and *C. naumanni* has been used since for the Miocene *Comptoniphyllum* in Japan.

In 1951, T. TANAI (1951; 70) published three forms on this species; a) triangular-shaped leaf, b) rounded-shape leaf, and c) that intermediate between a-type and b-type, but the reason of his separation was not reported. The writer is inclined to consider the c-type should be included in b-type.

Examining a living species of *Comptonia peregrina*, the writer has recognized that, these two forms exist together on same twigs. Moreover, the two forms are in the same locality where many specimens of *Comptoniphyllum naumanni* are yielded. However, with regard to the size of the leaf, the fossil specimens are generally larger than the living species.

Recently, the writer has become aware of the existence of a long and narrow leaf in the specimens of the Noroshi Flora. Thus, the leaf-shapes of the *C. naumanni* from the Hokuriku region are to be summerized as in the table 2, to follow.

As to the stratigraphical sequence of the three *Comptoniphyllum*-bearing floras, the youngest is the Notonakajima Flora, the horizon of which overlies unconformably the "Mangrove Fauna" in certain local areas; the next younger is the Noroshi Flora which belongs to the same horizon as the "Mangrove Fauna." The oldest is the Kuragatake Flora, which underlies conformably the horizon of its characteristic Miocene fauna, as shown

in the Table-3.

Table-2 : The leaf-shapes of *Comptoniphyllum naumanni* from the Notonakajima, Noroshi and Kuragatake Floras, etc.

Character \ Flora		Notonakajima Flora	Noroshi Flora			Kuragatake Flora	
		Kanmachi Tsuchikawa	Noroshishin Yamabushiyama	Takaya Wanizaki	Ohsaki	Kuragatake Mikoshozu	Kawaminami
Leaf	Shape*	Obtusilobus ~ Deltoidolobus	Obtusilobus ~ Deltoidolobus & Augustifolius	Deltoidolobus	Deltoidolobus	Obtusilobus ~ Deltoidolobus	Deltoido-lobus
	Length	4 — 7 cm	7 — 24 cm	7 — 12 cm	5.5 — 8 cm	8 — 14 cm	8 — 11 cm
	Width	0.5 — 1.4 cm	0.6 — 2.8 cm	1.2 — 2.1 cm	0.8 — 1.4 cm	1.4 — 2.4 cm	0.9 — 1.6 cm
	L/W	5 — 8	6 — 12	5 — 7	6 — 7	5 — 7	7 — 11
Segments	Number**	11 — 13	13 — 24	13 — 16	9 — 12	12 — 16	18 — 22
	Dissection	Complete, reaching midvein.	Deeply incised	Complete, reaching midvein	Deeply incised	Complete, reaching midvein.	Complete, reaching midvein.
	Apex	Obtusely acuminate	Rounded or Obtusely acuminate	Acuminate or Acute	Acute	Obtusely acuminate	Obtusely acuminate
Petiol	Length	?	3 — 11 mm	2 — 4 mm	2 — 3 mm	3 — 5 mm	?
Lateral veins of Segments	Angle	70° — 85°	60° — 85°	70° — 85°	60° — 85°	60° — 85°	70° — 90°
	Number	1 — 3	2 — 4	2	2	1 — 3	1 — 2

* See plate VIII, figs. 1–9.

** It would be the case if the specimens were complete.

As shown in the table-2, both the ratio of the length to the width and the numbers of segments, suggest a very close resemblance between the specimens of Noroshishin and those of Kawaminami. This shows that the *Comptoniphyllum* bearing layers from Noroshishin and Kawaminami belong to one and the same horizon; in fact, "two horizons" exist in the "Mangrove Fauna".

Table-3 : Stratigraphical sequence of the three *Comptoniphyllum*-bearing floras in the Hokuriku region, Central Honshû, Japan.

Age		Formation	Fauna	Flora
Middle Miocene	Upper	Higashibessho	Non characteristic fossils	Notonakajima
	Middle	Kurosedani	"Mangrove Fauna" *Operculina complanata-Miogypsina kotoi* Zone	Noroshi
	Lower		Non characteristic fossils	Kuragatake

On the other hand, Notonakajima species show very close resemblance to those of the Kuragatake, while, the former is defined to overlies the "Mangrove Fauna."

To understand all these, the writer ventures an inference that these fossil plants were growing under the same condition, almost the same, but for the humidity which must have been stronger in the Kuragatake area than in the Notonakajima area.

Now, the number of segments of *Comptoniphyllum*-leaves varies according to the horizons of the three floras. The Noroshi leaves (especially the Noroshishin specimens) and Kawaminami leaves have many segments like the Palaeogene species of *Comptonia yanagisawae* found in the Jôban coal-field, and described by K. Huzioka and K. Suzuki in 1957 (K. Huzioka: 1961; 61-63, III, figs. 1-6). They are as many as 22, and differ from the common type of the *Comptoniphyllum naumanni* in which segments are at most 13; the leaves are more than 15cm in length in the former, while they are 10± 2 cm in the latter. Thus, the writer ventures an inference that those characteristic features of leaves suggest their belonging to the horizon of the "Mangrove Fauna," and also that they were growing in a more moist condition than the others. All these features are considered to indicate that these leaves prove to be the ancient form *C. naumanni*.

By the same reason, in the living species *Ginkgo biloba* Linné (M. Sakisaka: 1958) shoot has leaves larger than those of stem or trunk; besides there is the fact that the adult leaves have only one sinus each, while those of shoots have many, deeply incised lobes; when the tree was planted in the moist area, many leaves grew larger with numerous deeply incised lobes.

In *Myrica rubra* which bears entire, ever-green leaves, the younger trees of one year old grow leaves with serrated margin, 5-7 in numbers (see plate I, fig. 2). This seems to show that in the younger stage of growth appeared the features characteristic of the ancient type, *Myrica rubra*.

The facts mentioned above signify that: a) in moist are (namely, river

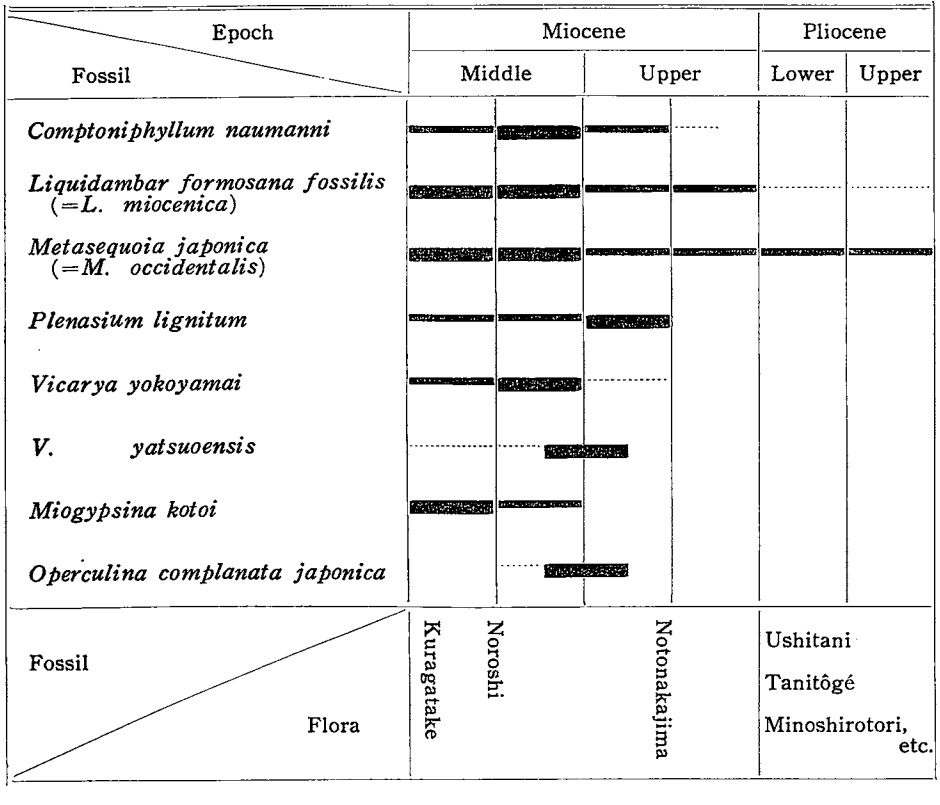
sides, lagoon banks, etc.) on the one hand, and b) in the younger stage of growth, the characteristic segmented forms appear vigorously and in abundance.

The situation a) is represented by the fossils from Noroshishin and Kawaminami, suggesting that these areas could have been moist in climate. The Palaeogene species of *Comptonia yanagisawae* may belong to b): it might be an ancestral type of *Comptoniphyllum naumanni*, consequently, if the Noroshishin specimens occurred in the Palaeogene strata, it could have been identified with the Jôban species. Thus, the writer considers that there is a recurrence in the descendants of the characteristic features in the ancestral forms.

VI. Relation of the *Comptoniphyllum* with other Miocene Index Fossils in the Hokuriku Region.

Comptoniphyllum naumanni is an important index fossil of the Middle Miocene age in the Japanese Islands. Its occurrence in Hokuriku region is quite important for the study of stratigraphical correlation. The writer tries

Table-4 : Relationship of the *Comptoniphyllum naumanni* with other Miocene fossils in the Hokuriku region.



to summerize the relation of *C. naumanni* with other Miocene fossils, as following table-4.

VII. Conclusion

1. In the Inner Side of Central Honshû (Hokuriku region), the *Comptoniphyllum*, bearing floras are found to correspond to the so-called "Daijima-type flora," and these are divided by the writer into three floras, namely the Kuragatake, the Noroshi and the Notonakajima, counted from below upwards of the stratigraphic succession.

2. On the name of *Comptoniphyllum*: the writer can not recognize that there are any distinct characters among *Comptonia* (Myricaceae), *Dryandra* and *Banksia* (Proteaceae) and *Lyonothamnus* (Rosaceae), etc. from one another. Moreover, he has recognized the scars that were due to the life activities (ex. fungi): thus he agree with idea that *Comptoniphyllum* resembles rather *Lyonothamnus* of Rosaceae than the others. Thus, the fossil genus *Comptoniphyllum* (A. G. Nathorst, 1888) should be used for the Miocene fern-like pinnatifid leaves from the Japanese Islands.

3. *Comptoniphyllum* has one species, named *C. naumanni*, with which had been identified by S. Endô and H. Morita (1933) *C. japonicum*. These two species were described by A. G. Nathorst (1888).

4. The varieties in form of the leaves of *C. naumanni* indicate the horizons of the stratigraphical succession: the common forms are found in the Notonakajima and the Kuragatake Floras; the other, the Noroshi Flora is characterized by the form with many segmented-lobes, also being larger in size. As to the cause of this fact, the writer considers that the Noroshi-shin and the Kawaminami specimens might have grown in the moist areas.

5. The Palaeogene species *Comptonia yanagisawae* may be regarded as the ancestor of *Comtoniphyllum naumanni*, by reason that the appearance of the leaf feature which seems to have characterized the ancestral form is found in the descendant.

6. On the annihilation of the *Comptoniphyllum*: this is a problem difficult to the writer to understand. It is well known that there is the arctic fauna of the upper Miocene age, so that the climate is conjectured to have changed cooler from the middle Miocene toward upper Miocene; it is due to this change of climate that the subtropical or warm temperate floras of the middle Miocene do not appear in the upper Miocene.

However, the *Comptoniphyllum* would have grown in either temperate or cool climates, so that, the writer is inclined to believe that this genus does not appear to have perished only because of the climatic changes.

VIII. References

A

ARNOLD, C. A. (1947) : An Introduction to Palaeobotany. *433. pp. McGraw-Hill Book Co.*

ASAMA, K. (浅間一男) (1960) : Evolution of the Leaf Forms through the Ages explained by the Successive Retardation and Neoteny. *Sci. Rep. Tohoku Univ. 2nd Ser., Special Vol. No. 4, pp. 252–280, pls. 26–29.*

AXELROD, D. I. (1956) : Mio-Pliocene Floras from West-Central Nevada. *Univ. California Pub. Geol. Sci. Vol. 33, pp. 1–322, pls. 1–32.*

B

BAILEY, L. H. (1950) : The Standard Cyclopedia of Horticulture, Vol. I-III. *Vol. I; A-E, 1200 pp. 1469 figs.*

BENSON, L. (1957) : Plant Classification. *688 pp. D. C. Heath & Co., Boston.*

BERRY, E. W. (1906) : Living and Fossil Species of *Comptonia. Amer. Nat. Vol. XL, pp. 498–502.*

———— (1919) : Upper Cretaceous Floras of the Eastern Gulf Region in Tennesse, Mississippi and Georgia. *U. S. Geol. Surv. Prof. Paper 112.*

BRITTON, N. L & H. A. BROWN (1896) : Illustrated Flora of the Northern United States, Canada and the British Possessions. Vol. I. Ophioglossaceae to Aizoaceae. *pp. 1–612, figs. 1–1425*

C

CHANEY, R. W. (Editor : 1944) : Pliocene Floras of California and Oregon. *Carnegie Inst. Washington, Pub. 553, pp. 1–407, pls. 1–64.*

E

ENDÔ, S. (遠藤誠道) (1931) : 新生代の化石植物 : 岩波講座 *pp. 3–44.*

———— (1933) : 同 上 (増補), *pp. 31–50.*

———— (1939) : Some new and interesting Miocene plants from Tyosen (Korea). *Jubilee Pub. Commem. Prof. H. YABE's 60th Birthday. Vol. I, pp. 333–349, pl. 23.*

———— (1954) : Notes on the Cenozoic plants of East Asia. 5 : Two new species of fossil *Comptonia* from Japan. *Kumamoto Jour. Sci., Ser. B, No. 4, pp. 4–5, pls. I & II.*

———— (1955) : Icones of Fossil Plant from Japanese Islands (in Japanese). *Sangyo Tosho Co., Tokyo. pls. 1–51.*

———— et H. MORITA (森田日子次) (1932) : Notes on the Genera *Comptoniphyllum* and *Liquidambar. Sci. Rep. Tohoku Imp, Univ., Sendai, 2nd Ser., Vol. XV, pp. 41–53, pls, V-VII.*

ETTINGSHAUSEN, C. v. (1858) : Die Blattskelete der Aptalen, eine vorarbit zur Interpretation der Fossilen Pflanzenreste. *Denksch. d. K. K. Akad. d. Wissenschaften Wien Naturselbstdruck mittheilt. Bd. XV, S. 181–272, Taf. I-LI.*

————(1888) : Contribution of the Tertiary Flora of Australia. *Mem. Geol. Surv. New South Wales, Palaeont. No. 2, pp. 1–189, pls. I-XV.*

H

HEER, O. (1856) : Flora Tertiaria Helvetiae ; Die Tertiäre Flora der Schweiz. *Bd. II, S. 1–110, Taf. LI-C.*

HUZIOKA, K. (藤岡一男) (1961) : A New Palaeogene Species of the Genus *Comptonia* from Jôban Coal-Field, with Reference to the Stratigraphical Consideration of the Tertiary *Comptonia* in Northeastern Japan. *Jour. Min. Coll. Akita*

Univ., Ser. A, Vol. I, No. 1, pp. 60–68, pl. III.

———— (1963) : 阿仁合植物群と台島植物群。化石, *No. 5, pp. 39–50.*

I

ICHIHARA, M. (市原 実), H. ISHIO (石尾 元), A. MORISHITA (森下 晶), T. NAKAGAWA (中川衷三) & K. TSUDA (津田禾粒) (1950) : 富山県及び石川県の地学的研究(その2), 金沢・石動・福光地域。地学, *Vol. 2, pp. 17–25.*

ICHIKAWA, W. (市川 渡), Y. KASENO (粕野義夫) & K. KOJIMA (小島和夫) (1955) : On the Miocene Non-Marine Diatomite in the Vicinity of Nakajima-Machi, Noto Peninsula, Japan (in Japanese). *Jour. Geol. Soc., Japan, Vol. 61, No. 719, pp. 381–386.*

IKEBE, N. (池辺展生) (1949) : 富山県西部及び石川県東部の第三紀層。地学, *Vol. 1, No. 1, pp. 1–13.*

ISHIDA, S. (石田志朗) & K. MASUDA (増田孝一郎) (1956) : Geology of the Northeastern Region of Noto Peninsula, Japan (in Japanese). *Jour. Geol. Soc., Japan, Vol. LXII, No. 735. pp. 703–716.*

L

LUDWIG, R. (1859–61) : Fossile Pflanzen a. d. ältesten Abteilung der Rheinisch-Wetterauer Tertiäre Formation. *Palaeontgr. Vol. VIII, S. 96, Taf. XXX, fig. 7–15.*

M

MATSUO, H. (松尾秀邦) (1951) : 日本及び朝鮮に於ける *Vicarga* 属分布図に附して。新生代の研究, *No. 9, pp. 9–11.*

———— (1952) : On the Plant-fossils of the Neogene at Kanmachi, Kumaki-Mura, Kashima Gun, Ishikawa Prefecture (in Japanese). *Jour. Geobot., Vol. I, No. 3, pp. 21–23, pl. I.*

———— (1954) : 北陸地方の中新世植物化石について。1：コンプトニフィルム属。自然と社会, *No. 2, pp. 2–6, pl. 1.*

———— (1958) : 石川県手取川上流に産出した *Comptoniphyllum* について。*Jour. Geol. Soc. Japan, Vol. 64, No. 750, p. 156.*

———— (1966) : A Note of the Neogene Flora of the Inner Side of Central Honshû, Japan (in Japanese). *Fossil. No. 12* (in Printing).

———— et K. ŌMURA (大村一夫) (1965) : On the Kuragatake Flora from the Outskirts of Kanazawa City, Central Japan (in Japanese). *Jour. Geol. Soc. Japan, Vol. LXXI, No. 834, pp. 148–149.*

N

NAKAI, T. (中井猛之進) (1935) : 東亜植物。岩波書店, *pp. 1–283.*

NATHORST, A. G. (1888) : Zur fossilen Flora Japan's. *Palaeont. Abh. Bd. IV, Hft. 3, pp. 197–250, pls. XVII-XXX.*

O

ŌISHI, S. (大石三郎) & K. HUZIOKA (1941) : Studies on the Cenozoic Plants of Hokkaido and Karahuto. III. *Comptoniphyllum* from Hokkaido and Karahuto. *Jour. Fac. Sci., Hokkaido Imp. Univ., Ser. IV, Vol. VI, No. 2, pp. 201–204, pl. XLV.*

OKUTSU. H. (奥津春生) (1955) : On the Stratigraphy and Paleobotany of the Cenozoic Plant Beds of the Sendai Area, *Sci. Rep. Tohoku Univ., 2nd. Ser. Vol. XXVI, pp. 1–114, pls. 1–8.*

ŌYAMA, K. (大山 桂) (1950) : Biocoenological Studies on the Mangrove Swamps, with Descriptions of New Species from Yatsuo Group. *Rep. Geol. Surv. Japan, No. 132.*

T

TANAI, T. (棚井敏雅) (1952) : 本邦石炭の原植物の研究の綜括—本邦における新生代植物群の概観：炭田探査審議会事業報告II, *pp. 61–83, Figs. 1–15.*

TANAI, T. (1955) : Illustrated Catalogue of Tertiary Plants in Japanese Coal Fields. I. Early and Middle Miocene Floras (in Japanese). *Rep. No. 63, Geol. Surv., Japan, A. C. IV, pp. 1–16, pls. I–XXII.*

———— (1961) : Neogene Floral Change in Japan. *Jour. Fac. Sci. Hokkaido Univ., Ser. IV, Vol. XI, No. 2, pp. 119–398, pls. 1–32.*

———— K. HUZIOKA & H. MATSUO ; R. W. CHANEY (Editor) (1963) : Tertiary Floras of Japan, Miocene Floras. *Collab. Assoc. Commem. 80th Anniv. Geol. Surv. Japan, pp. 262, pls. 1–56.*

TSUDA, K. (津田禾粒) (1953) : 富山県八尾町附近の地質。*Jour. Fac. Sci. Niigata Univ., Ser. II, Vol. I, No. 2, pp. 1–35.*

———— (1955) : On the Sedimentary Environment of the Yatsuo Group. A Study of the Sedimentary Environment of the Miocene Deposits in the so-called "Green-Tuff" Region. Part (1) (in Japanese). *Jonr. Geol. Soc. Japan, Vol. 61, No. 722. pp. 532–542*

S

SAKAI, ?. (1940) : *Comptoniphyllum* の新産地. *Jour. Geol. Soc. Japan, Vol. 47, No. 557, p. 9.*

SAKISAKA, M. (向坂道治) (1958) : 銀杏の研究 (A Study of *Ginkgo biloba*). 風間書房, 東京, *139 pp.*

SCHIMPER, W. Ph. (1890) : Palaeophytologie (Handbuch der Palaeontologie of K. A. ZITTEL). *S. 1–958.*

SONOBE, R. (薗部龍一) (1940) : Explanatory Text of the Geological Map of Japan, Scale 1 : 75,000 "Fukui". *Imp. Geol. Surv. Japan, Zone 22, Col. XII, Sheet 149, pp. 1–76.*

SUZUKI, K. (鈴木敬治) (1961) : The Important and Characteristic Pliocene and Miocene Species of Plants from the Southern Part of the Tohoku District, Japan. *Sci. Rep. Fac. Art & Science, Fukushima Univ., No. 10, pp. 1–95, pls. 1–19.*

———— (1963) : 植物化石よりみた東日本新第三系。—中新統下部層と植物化石群—化石, *No. 5, pp. 63–77.*

U

UNGER, F. (1852) : Die fossile flora von Notzka. *Denkschr. Ak. Wiss. Wien, Math. nat. Kl., Bd. 4, S. 131–197, Taf. XXII–LXVIII.*

Y

YABE, H. (矢部長克) (1901) : *Comptoniphyllum* の新産地。*Jour. Geol. Soc., Japan, VIII, No. 94, p. 328.*

IX. Glossary of Men's, Local and Strtigraphical Names.

A

Aikawa ····· 福井県丹生郡見村鮎川
O.AOJI (AOJI Otoji) ····· 青 地 乙 治

E

S. ENDÔ (ENDÔ Seidô) ····· 遠 藤 誠 道

G

Gohyaku-togé ····· 石川県能美郡新丸村五百峠

H

I. HAYASAKA (HAYASAKA Ichirô) ····· 早 坂 一 郎
Higashibessho Formation ····· 東 別 所 累 層
Higashiyamanaka ····· 石川県珠洲市狼煙町東山中
Hokuriku Region ····· 北陸地方 (福井, 石川, 富山)
K. HUZIOKA (HUZIOKA Kazuo) ····· 藤 岡 一 男

I

Ika, T. (Ika Tomomune) ····· 井家友宗
Ikebe, N. (Ikebe Nobuo) ····· 池辺展生
Ishida, S. (Ishida Shirô) ····· 石田志朗
Ishikawa Prefecture ····· 石川県

J

Jike ····· 富山県上新川郡船峅村寺家
Jike Flora ····· 寺家植物群
Jike Mudstone ····· 寺家泥岩層
Jôban Coal-field ····· 常磐炭田

K

Kamikanazawa ····· 茨城県久慈郡太子町上金沢
Kamino ····· 石川県石川郡鳥越村上野
Kanmachi ····· 石川県鹿島郡中島町上町
Kaseno, Y. (Kaseno Yoshio) ····· 舶野義夫
Kawaminami ····· 石川県江沼郡山中町河南
Kawarayama ····· 石川県石川郡鳥越村河原山
Kawasaki, K. (Kawasaki Kazumi) ····· 川崎一美
Kinoura ····· 石川県珠洲市狼煙町木ノ浦
Kirii, Y. (Kirii Yoshihiro) ····· 桐井義博
Kita K. (Kita Kimio) ····· 北公夫
Kobatake, ? ····· 小畠某
Kourade ····· 石川県珠洲市狼煙町小浦出
Kunimi-Mura ····· 福井県丹生郡国見村
Kuragatake Flora ····· 倉ケ岳植物群
Kuragatake-machi ····· 石川県金沢市倉ケ岳町
Kurosedani Formation ····· 黒瀬谷累層

M

Masatani, K. (Masatani Kiyoshi) ····· 正谷清
Masuda, K. (Masuda Kôichirô) ····· 増田孝一郎
Mikoshozu ····· 石川県石川郡鳥越村神子清水
Morita, H. (Morita Hikoji) ····· 森田日子次
Muramoto, J. (Muramoto Junryo) ····· 邑本順亮
Muromaki-Gawa ····· 室牧川

N

Nakai, T. (Nakai Takenoshin) ····· 中井猛之進
Nagahashiri ····· 富山県上新川郡大沢野町長走
Noroshi Flora ····· 狼煙植物群
Noroshi-machi ····· 石川県珠洲市狼煙町
Noroshishin (Noroshin) ····· 石川県珠洲市狼煙町狼煙新
Noto Peninsula ····· 能登半島
Notonakajima Flora ····· 能登中島植物群
Nozoki ····· 石川県石川郡犀川村覗
Nozumi-Gawa ····· 野積川

O

Ohsaki ····· 石川県珠洲市上野町遭崎
Ogoya Mine ····· 石川県小松市西尾町尾小屋鉱山
Onma Fauna (Omma fauna) ····· 大桑植物群
Orito ····· 石川県珠洲市狼煙町折戸
Ôtsuchi ····· 石川県江沼郡東谷奥村大土

S

Sai-Kawa ..... 犀　　川
Sakisaka, M. (Sakisaka Michiharu) ..... 向 坂 道 治
Sasazu ..... 富山県上新川郡大沢野町笹津
Sasazu Station, Takayama Line ..... 高山線笹津駅
Satomi, N. (Satomi Nobuo) ..... 里 見 信 生
Shimohinokinai ..... 秋田県仙北郡西木村下桧木内
Shiramine-Mura ..... 石川県石川郡白峯村

T

Takaya ..... 石川県珠洲市狼煙町高屋
Tanai, T. (Tanai Toshimasa) ..... 棚 井 敏 雅
Taninami, S. (Taninami Shozô) ..... 谷 波 正 三
Tarumi-Daki ..... 樽見滝(石川県羽咋郡志雄町野田部落北2kmの地点に存在する.)
Tedori-Gawa ..... 手　取　川
Tetori Flora ..... 手取植物群
Tôbu Formation ..... 燈 豊 累 層
Torigoé Flora ..... 鳥越植物群
Torigoé-Mura ..... 石川県石川郡鳥越村
Toyama Prefecture ..... 富　山　県
Tsuchikawa ..... 石川県鹿島郡中島町土川
Tsuda, K. (Tsuda Karyu) ..... 津 田 禾 粒

W

Wanizaki ..... 石川県珠洲市狼煙町鰐崎

Y

Yabe, H. (Yabe Hisakatsu) ..... 矢 部 長 克
Yakiyama ..... 八木山 (富山県上新川郡大沢野町笹津近傍)
Yatsuo-Machi ..... 富山県婦負郡八尾町

Z

Zyoyama ..... 石川県石川郡鳥越村城山

Plate I. (Nat. size)

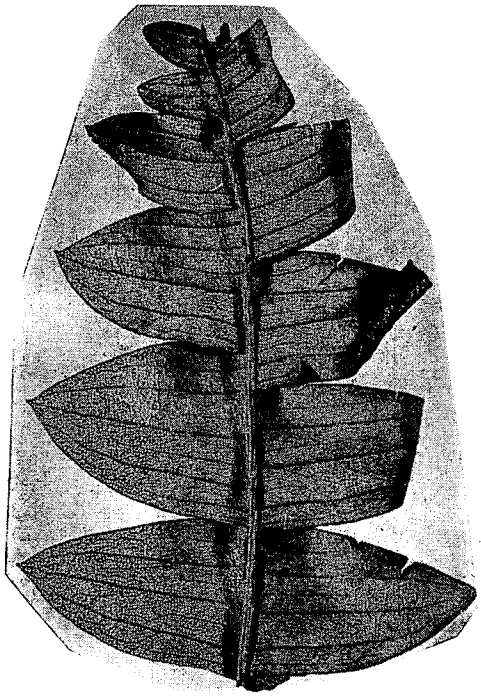
For comparison with *Comptoniphyllum naumanni* NATHORST.

Figs. 1 & 2. *Banksia grandis*
Cultivated in Melbourne Botanic Gardens.
Loc. : Western Australia.
Fig. 2 is the reverse side of fig. 1.

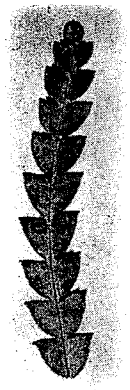
Figs. 3 & 4. *Dryandra formosa*
Culitvated in Melbourne Botanic Gardens.
Loc. : S-Western Australia.
Fig. 4 is the reverse side of fig. 3.

Fig. 5. *Comptonia peregrina*
Loc. : Mt. Pisgah, North Calorina, U. S. A.
Repository ; Herb., Kanazawa Univ.

Pl. I



2



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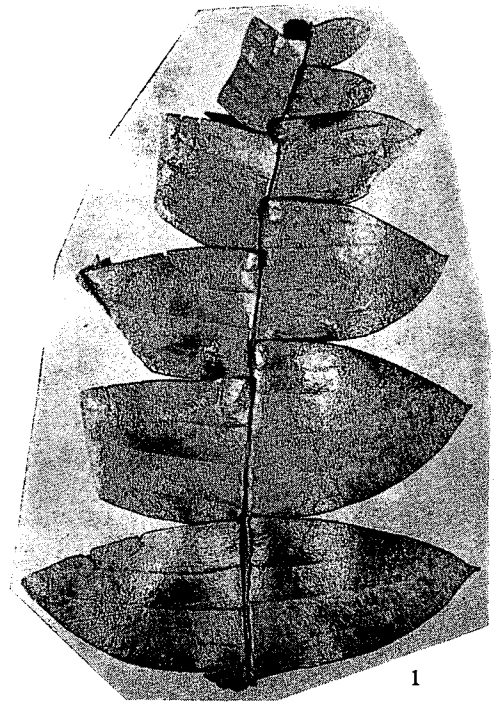

1

Phot.: H. Matsuo

Plate II. (Nat. size)

Fig. 1. *Myrica* (*Morella*) *perifera*
For comparison with leaves of shoots of *Myrica rubra.*
Loc. : Duxal Co. Florida, U. S. A.
Reg. No. : Herb., Univ., Kanazawa 15628.

Figs. 2 & 3. *Myrica rubra* (Older stage).
For comparison with fig. 4.
Loc. : Tokushima Prefecture, Shikoku, Japan.
Repository : Herb., Kanazawa Univ.

Fi. 4. *Myrica rubra* (one year old).
For comprison with *Comptonia* and *Comptoniphyllum.*
Loc. : Tokushima Prefecture, Shikoku, Japan
Repository : Herb., Kanazawa Univ.

Pl. II

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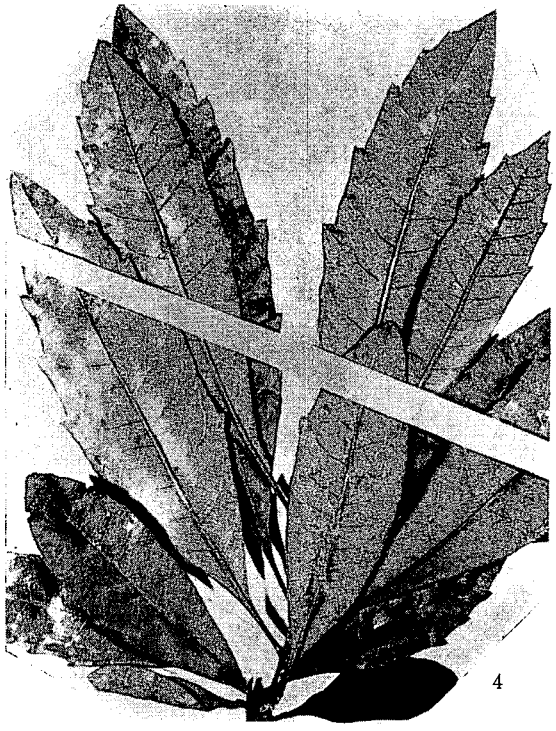

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Phot.: H. MATSUO

Plate III. (Nat. size)

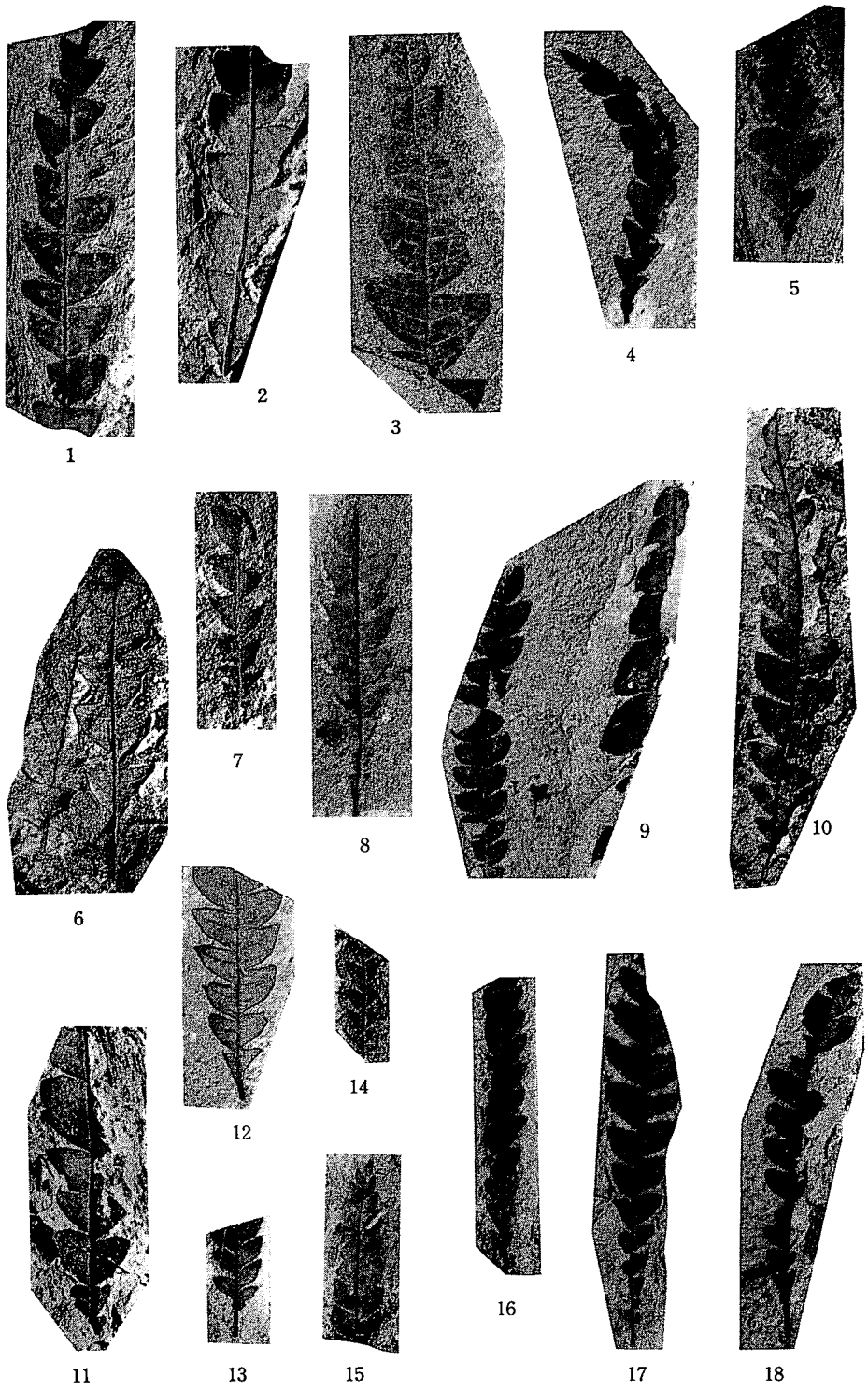
Comptoniphyllum naumanni NATHORST

Figs. 1–8, 10–12, 14,17 & 18 show a Deltoidolobus type.

Figs. 9, 13, 15 & 16 show an Angustifolius type.

Fig. 1. Loc.: Wanizaki. Reg. No. DGLAKZ-10963.
Fig. 2. Loc.: Kuragatake. Reg. No. DGLAKZ-14942.
Fig. 3. Loc.: Takaya. Reg. No. DGLAKZ-10484.
Fig. 4. Loc.: Ohsaki. Reg. No. DGLAKZ-10965.
Fig. 5. Loc.: Mikoshozu. Reg. No. DGLAKZ-10947.
Fig. 6. Loc.: Jike. Reg. No. DGLAKZ-10975.
Fig. 7. Loc.: Sasazu. Reg. No. DGLAKZ-10971.
Fig. 8. Loc.: Yamabushi-yama, Noroshi-Machi. Reg. No. DGLAKZ-10487.
Fig. 9. Loc.: Kawaminami. Reg. No. DGLAKZ-10559a.
Fig. 10. Loc.: Noroshishin. Reg. No. DGLAKZ-10542.
Fig. 11. Loc.: Kuragatake. Reg. No. DGLAKZ-14648.
Fig. 12. Loc.: Takaya. Reg. No. DGLAKZ-10496a.
Fig. 13. Loc.: Noroshishin. Reg. No. DGLAKZ-10539.
Fig. 14. Loc.: Kanmachi. Reg. No. DGLAKZ-10970b.
Fig. 15. Loc.: Noroshishin. Reg. No. DGLAKZ-10539.
Fig. 16. Loc.: Noroshishin. Reg. No. DGLAKZ-11015.
Fig. 17. Loc.: Noroshishin. Reg. No. DGLAKZ-10980b.
Fig. 18. Loc.: Yamabushi-yama, Noroshi-Machi. Reg. No. DGLAKZ-10967.

Pl. III



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Phot: H. Matsuo

Plate IV. (Nat. size)

Comptoniphyllum naumanni NATHORST

Figs. 1–12 show an Obtusilobed type.

Fig. 1. Loc. : Kamino. Reg. No, DGLAKZ–10959.
Fig. 2. Loc. : Noroshishin. Reg. No. DGLAKZ–10560.
Fig. 3. Loc. : Kanmachi. Reg. No. DGLAKZ–10972.
Fig. 4. Loc. : Takaya. Reg. No. DGLAKZ–10454.
Fig. 5. Loc. : Kuragatake. Reg. No. DGLAKZ–14722b.
Fig. 6. Loc. : Noroshishin. Reg. No. DGLAKZ–10988.
Fig. 7. Loc. : Kuragatake. Reg. No. DGLAKZ–14704a.
It shows two pitted scars.
Fig. 8. Loc. : Noroshishin. Reg. No. DGLAKZ–10993.
Fig. 9. Loc. : Wanizaki Reg. No. DGLAKZ–10963.
Fig. 10. Loc. : Jike. Reg. No. DGLAKZ–11011.
Fig. 11. & 12. Loc. : Kanmachi. Reg. No. DGLAKZ–10958.
Fig. 11. shows the reverse side of fig. 12
Fig. 9 and figs. 11, 12 show a few fine pitted scars.

Pl. IV

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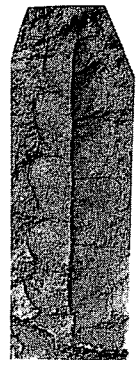
2



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12

Phot.: H. Matsuo

Plate V. (Nat. size)

Comptoniphyllum naumanni NATHORST

Fig. 1–8 show an Obtusilobed type.

Fig. 9 shows an Angustifolius type.

Fig. 1. Loc. : Kuragatake. Reg. No. DGLAKZ–14623a.
Fig. 2. Loc. : Takaya. Reg. No. DGLAKZ–10497a.
Fig. 3a. Loc. : Yamabushi-yama, Noroshi-Machi. Reg. No. DGLAKZ–10488.
Fig. 4. Loc. : Noroshishin. Reg. No. DGLAKZ–11014.
Fig. 5. Loc. : Noroshishin. Reg. No. DGLAKZ–10986.
Fig. 6. Loc. : Noroshishin. Reg. No. DGLAKZ–10983.
Fig. 7. Loc. : Noroshishin. Reg. No. DGLAKZ–10957. It shows a pitted scar.
Fig. 8. Loc. : Takaya. Reg. No. DGLAKZ–10486b.
Fig. 9 Loc. : Kuragatake. Reg. No. DGLAKZ–14672a.

Pl. V

Phot.: H. Matsuo

Plate VI. (Nat. size)

Comptoniphyllum naumanni NATHORST

Figs. 1–4, 6–10 show an Angustifolius type.

Fig. 5 shows a dwarf leaf.

Fig. 1. Loc. : Noroshishin. Reg. No. DGLAKZ-10960a.
Fig. 2. Loc. : Noroshishin. Reg. No. DGLAKZ-10979.
Fig. 3. Loc. : Noroshishin. Reg. No. DGLAKZ-10956a.
Fig. 4. Loc. : Noroshishin. Reg. No. DGLAKZ-11013b.
Fig. 5. Loc. : Kuragatake. Reg No. DGLAKZ-14931a.
Fig. 6. Loc. : Takaya Reg. No DGLAKZ-10458b.
Fig. 7. Loc. : Noroshishin. Reg. No. DGLAKZ-10973a.
Fig. 8. Loc. : Noroshishin. Reg. No. DGLAKZ-10995.
Fig. 9. Loc. : Noroshishin. Reg. No. DGLAKZ.-11017a.
Fig. 10. Loc. : Noroshishin. Reg. No. DGLAKZ-11018.

Pl. VI

Phot.: H. Matsuo

Plate VII. (Nat. size)

Comptoniphyllum naumanni NATHORST

Figs. 1–4 show an Angutifolius type.

Figs. 5–8 show an Obtusilobus type.

Fig. 1. Loc. : Noroshishin. Reg. No. DGLAKZ-10968.
Fig. 2. Loc. : Noroshishin. Reg. No. DGLAKZ-11012.
Fig. 3. Loc. : Noroshishin. Reg. No. DGLAKZ-10541.
Fig. 4. Loc. : Noroshishin Reg. No. DGLAKZ-10981.
Fig. 5. Loc. : Noroshishin. Reg. No. DGLAKZ-10962.
Fig. 6. Loc. : Noroshishin. Reg. No. DGLAKZ-12454a.
Fig. 7. Loc. : Yakiyama. Reg. No. DGLAKZ-11019.
Fig. 8. Loc. : Orito. Reg. No. DGLAKZ-10969.

Pl. VII

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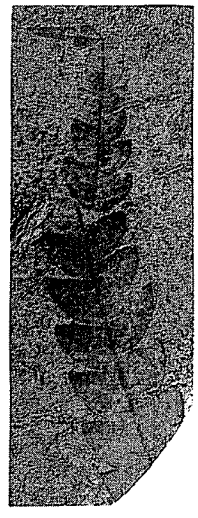

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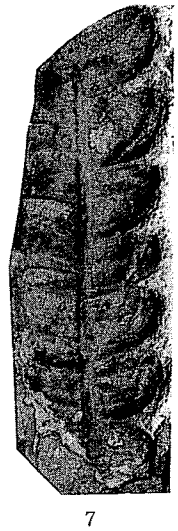

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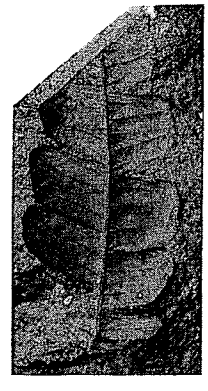


8

Phot.: H. Matsuo

Plate VIII.

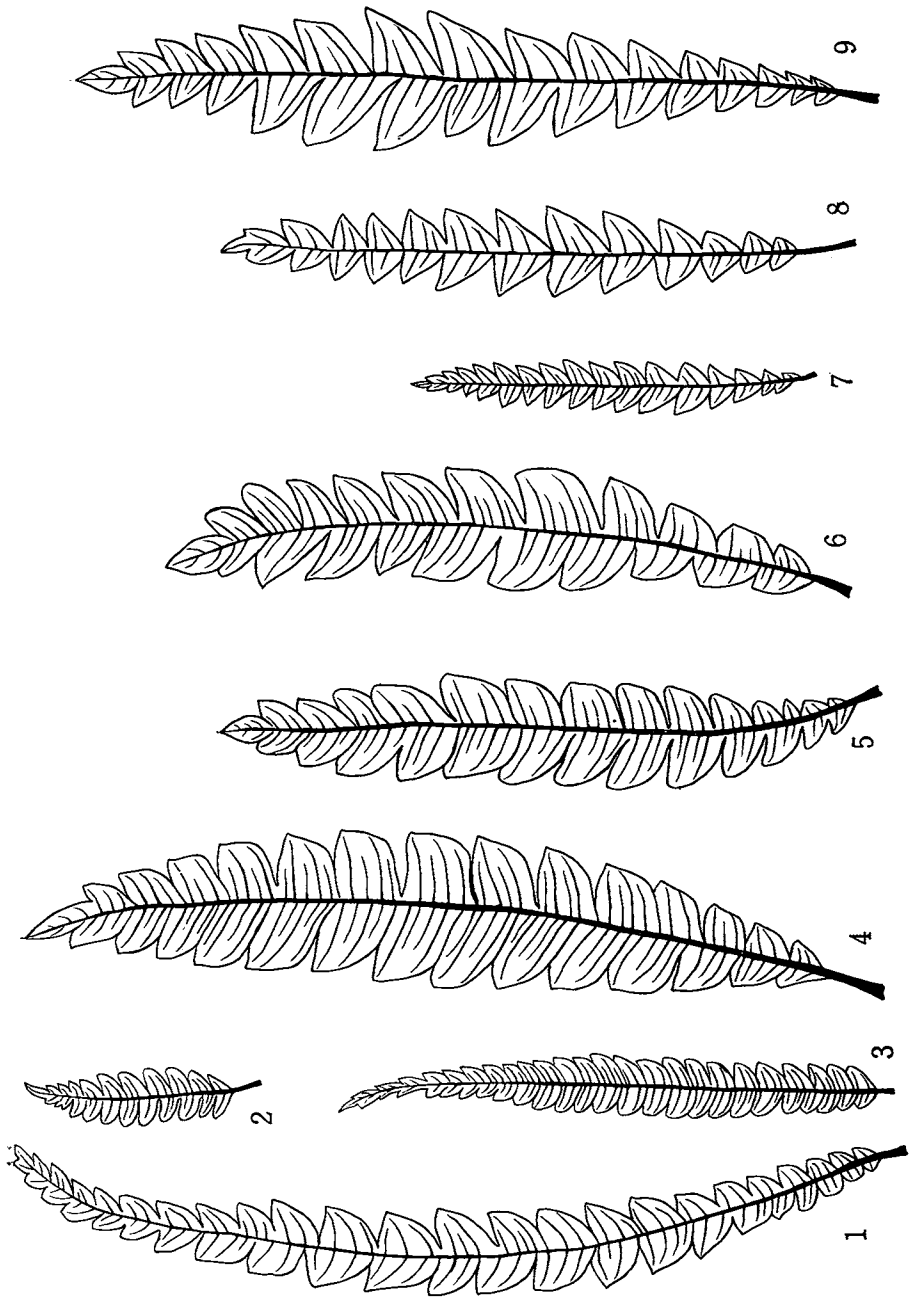
Variations of *Comptoniphyllum naumanni* NATHORST

Figs. 1–3. Angustifolius type (Similar to Palaeogene species of *Comptonia yanagisawae* HUZIOKA et SUZUKI).

Figs. 4–6. Obtusilobus type (Commonly fig. 6 : Similar to *Comptoniphyllum japonicum* NATHORST in 1888).

Figs. 7–9. Deltoidolobus type (Commonly fig. 8 : Similar to *Comptoniphyllum naumanni* NATHORST in 1888).

Pl. VIII



Del.: H. MATSUO